

**JAPANESE LAID-OPEN UTILITY
MODEL APPLICATION**

S53-128861 (1978)

Utility Model Application

March 23, 1977

Ishiro KATAYAMA Commissioner, Japan Patent Office

1. Title of the Design

Pressure Sensitive Switch Mechanism

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52 034965 Formal Examination

53128861 (Fukui)

SPECIFICATION

1. Title of the design

Pressure Sensitive Switch Mechanism

2. Claims

- (1) A pressure sensitive switch mechanism characterized by having a switch main body with a pressure sensitive resistor as a switching element and a spring inverting at a given pressure and so constructing it that the above pressure sensitive resistor is pushed via the above spring and at least the pressure sensitive resistor becomes the conductive state when inverting the spring.
- (2) The pressure sensitive switch mechanism according to Claim 1 characterized by having the above spring that is exchangeable with a spring having a different pressure at the time of inversion.

3. Detailed description of the invention

The present design relates to a pressure sensitive switch mechanism using a pressure sensitive resistor as a switching element. Specifically, the present design relates to a pressure sensitive switch mechanism made such that the pressure sensitive resistor and a spring inverting at a given pressure are combined and the pressure sensitive resistor is pushed via the spring.

Conventional switch structures have generally been constructed from a combination of metal contacts and a spring, but when the switch is repeatedly used, often troubles such as poor operation or malfunction, etc. occur due to aging of contacts caused, for example, by a spark discharge between the contacts or shaking of the contacts accompanied by vibration and impact.

In contrast to such a conventional mechanical switch, a switch using a pressure sensitive resistor has recently come to be increasingly used, eliminating the drawbacks of a conventional mechanical switch, has no problems of spark discharge and aging of contacts because there are no metallic contacts, and there is no poor operation or malfunction accompanied by vibration and impact and fewere secular changes.

However, a general structure of the switch using such a pressure sensitive resistor is a structure in which a pressure sensitive resistor is interposed between two electrode plates,

accordingly, for example, when the switch is pushed by hand to conduct the ON-OFF operation, whether the switch becomes the ON state to any degree is not clear and it was difficult to reliably perceive the ON-OFF operation of the switch. When the ON-OFF operating pressure is changed, a pressure sensitive resistor having a desirable pressure-sensing force must be prepared to replace it by a pressure sensitive resistor.

In view of the above circumstance, the purpose of present design is to provide a pressure sensitive switch mechanism by which a person operating the switch may perceive whether the switch becomes the ON state or the OFF state, i.e. whether the switch reliably operates or not by a click feeling, and the operating pressure of the switch may be changed without replacing the pressure sensitive resistor, and it substantially consists of a pressure sensitive switch mechanism characterized by having a pressure sensitive resistor and a spring inverting at a given pressure, constituting it so that the above pressure sensitive resistor is pushed via the above spring and at least the pressure sensitive resistor becomes the conductive state when inverting the spring.

The present design is described in detail hereafter with reference to in the drawings.

The pressure sensitive resistor is achieved by dispersing and mixing about 5 ~ 50% by volume of conductive particles, such as metallic particles or conductive carbon, etc., in an elastic insulator like rubber or a synthetic resin, such as silicone rubber, SBR, NBR, EPDM, IR, acrylic rubber, etc. and has is characterized by elastically deforming due to impressed pressure to change the electrical resistance or conductivity. As is seen in the same drawings, a pressure sensitive resistor is used as a switching element, the resistance of which is $10^5 \Omega\text{-cm}$ or greater in the non-pressure state and $10^3 \Omega\text{-cm}$ or below when applying pressure.

Fig. 2 shows an example of a switch body according to the present design, the structure of which is the same as that formerly proposed by the present applicant (UM Appl. S51-113897). In the drawing, 1 is a pressure sensitive resistor, 2 is a pressure plate, 3a, 3b are electrode plates, 4 is a non-conductive member, 5 is an electrode partition plate, 6 is a support, 6a is a stopper, and 7a, 7b are lead wires. Namely, the pressure plate 2 is arranged upside of pressure sensitive resistor 1, the two electrode plates 3a, 3b are arranged downside, and the non-conductive member 4 having elasticity is arranged around them. Electrode plates 3a, 3b are insulated from each other by the insulative electrode partition plate 5 arranged between them. A support 6 is arranged downside of electrode

plates 3a, 3b, with a stopper 6a protruding to the upper pressure plate 2 being formed at the rim of the support 6. A prescribed spacing l is provided between the upper end of stopper 6a and the pressure plate 2. If the pressure plate 2 is pushed down for only a distance l, it makes contact with the stopper 6a. The lead wires 7a, 7b are connected to the above electrode plates 3a, 3b, respectively.

In this switch body, if pressure is impressed on the pressure plate 2 to compress the pressure sensitive resistor 1, the electric resistance of pressure sensitive resistor 1 is reduced, and a lead wire 7a - electrode plate 3a - pressure sensitive resistor 1 - electrode plate 3b - lead wire 7b circuit is formed to become the conductive state. Then, if a pressure is impressed, the pressure plate 2 is in touch with the stopper 6a to control the compressive deformation received by the electrode partition plate 5 and prevent it from excessive compression.

This switch body may prevent the mechanical aging caused by excessive compression because it is provided with a stopper 6a, and it almost has no aging of the electrode plates accompanied by repeated use because the distortion of electrode plates 3a, 3b when applying pressure is reduced by using the mounting positions of the electrode plates 3a, 3b as the bottom surface of the pressure sensitive resistor 1, and also has the features of excellent environment resistance, etc. because the contacts of pressure sensitive resistor 1 and electrode plates 3a, 3b are completely sealed.

Fig. 3 is a sectional conceptual drawing showing the pressure sensitive switch mechanism relating to the present design using the switch body shown in Fig. 2.

In this pressure sensitive switch mechanism, as shown in the drawing, a switch body 8 is arranged in the lower part in a case 9 via holding members 10a, 10b. Switch body 8 is same as the switch body shown in Fig. 2, and attached numbers are also same as Fig. 2. This switch body 8 is so arranged that the pressure plate 2 thereof becomes the upside, above which is arranged a pressure rod 11 is arranged above it. The upper end of pressure rod 11 is fixed to a spring 12 inverting at a given pressure. The shape of spring 12 is invertible and convex relative to the above like a plate spring. A rubber sheet or diaphragm 13 covering the switch mechanism is arranged immediately on the spring 12.

Accordingly, if the rubber sheet or diaphragm 13 is pushed with a finger or another pushing

means, a pressure force is applied to the spring 12 to invert the spring 12, the pressure rod 11 fixed to the spring 12 by this inversion pushes the pressure plate 2 of switch body 8 arranged below the pressure rod 11, the pressure sensitive resistor 1 becomes the conductive state and the lead wires 7a, 7b become the conductive state. Namely, this pressure sensitive switch mechanism operates at a given pressure needed for the inversion of the spring.

On the other hand, when pressure is applied to the spring 12 to invert the spring 12, a click feeling is generated by the repulsive force, and the person operating the switch may perceive that the switch is reliably operating. The pressure needed for the inversion may be set to a prescribed pressure by using the rubber sheet or diaphragm 13 and selecting the material and shape of spring 12, therefore the ON-OFF operating pressure of switch may be arbitrarily selected without changing the pressure sensitive resistor 1.

Fig. 4 shows the pressure-distortion characteristic of spring used in the pressure sensitive switch mechanism and the operating state of a switch based on this characteristic. Namely, the distortion of the spring increases with a rise of pressure, the inversion is caused when reaching a prescribed pressure P_2 , and the switch goes from the OFF state to the ON state at this point in time. Subsequently, the distortion starts to lower with the reduction of pressure, the spring inverts again at some pressure P_1 and the switch returns to the OFF state.

The pressure sensitive switch mechanism relating to the present design is not restricted to the illustrated example. For example, it may be a switch for performing the ON-OFF operation by applying pressure using a pressure sensitive resistor as the switch body, and the switch may also be a shape made invertible at a given pressure using metal, resin or rubber, etc. as the material. Other various modifications of structure are also possible so long as they do not exceed the essence of the present design.

As described above, the pressure sensitive switch mechanism relating to the present design pushes the pressure sensitive resistor via the spring inverting at a given pressure, therefore the spring operates at a prescribed pressure needed for the inversion of spring, and a person operating the switch may reliably perceive the operation of the switch by a click feeling at the time of inverting the spring. The function of pressure detection termination may be discerned from the fact that the pressure required for the inversion may be set to a prescribed pressure by selecting the material and shape of

spring. Accordingly, this pressure sensitive switch mechanism may be applied to a pressure switch, a pressure safety device, etc.

4. Brief description of the drawings

Fig. 1 is a graph showing the relationship between the volume inherent resistance value and the compressiveness of a corresponding pressure sensitive resistor used in a pressure sensitive switch mechanism according to the present design versus the impressed pressure of the pressure sensitive resistor;

Fig. 2 is a sectional conceptual drawing showing an example of a switch body using the pressure sensitive resistor as the switching element;

Fig. 3 is a sectional conceptual drawing showing an example of a pressure sensitive switch mechanism according to the present design, and

Fig. 4 shows the pressure-distortion characteristic of the spring and the operating state of the switch based on this characteristic.

- 1 pressure sensitive resistor
- 1 pressure plate
- 3a, 3b electrode plates
- 4 non-conductive member
- 5 electrode partition plate
- 6 support
- 6a stopper
- 7a, 7b lead wires
- 8 switch body
- 9 case
- 10a, 10b holding members
- 11 pressure rod
- 12 spring
- 13 rubber sheet or diaphragm

5. List of attached documents

- (1) Specification 1
- (2) Drawings 1
- (3) Duplicate of application 1
- (4) Letter of attorney 1

6. Inventor and agents other than the above

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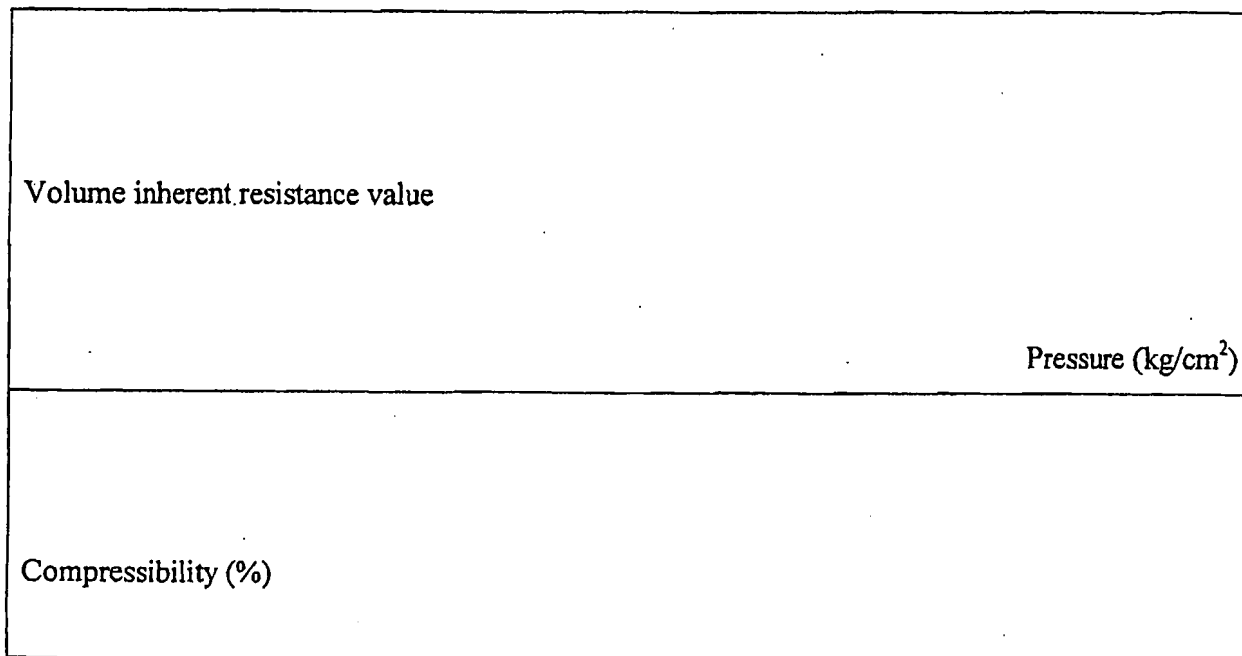
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[Fig. 1]

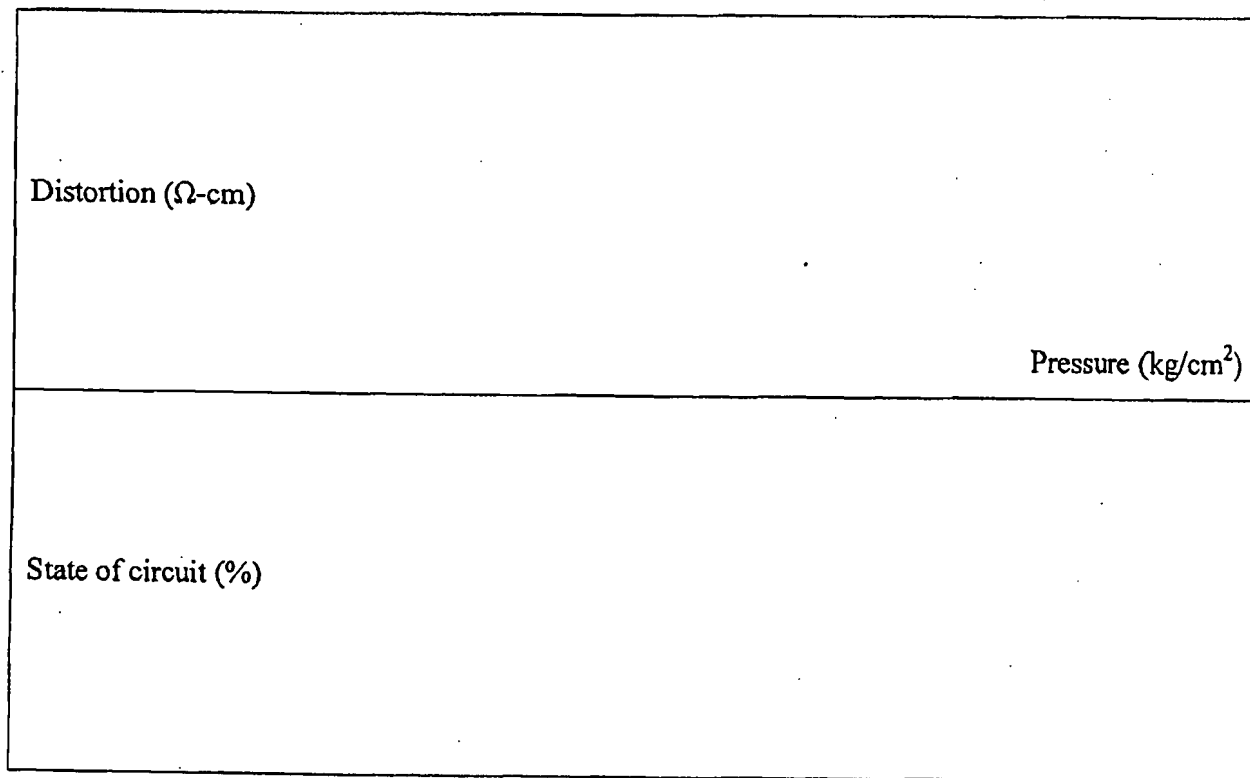




[Fig. 2]

[Fig. 3]

[Fig. 4]



CERTIFICATE OF TRANSLATION

I Roger P. Lewis, whose address is 42 Bird Street North, Martinsburg WV 25405, declare and state the following:

I am well acquainted with the English and Japanese languages and have in the past translated numerous English/Japanese documents of legal and/or technical content.

I hereby certify that the Japanese translation of the attached translation of documents identified as:

Laid Open Utility Model

S53-128861 (1978)

"Pressure Sensitive Switch Mechanism"

is to the best of my knowledge and ability true and accurate.

I further declare that all statements contained herein of our own knowledge, are true, that all statements of information and belief are believed to be true.



ROGER P. LEWIS

October 24, 2006